



Europäisches Patentamt
European Patent Office
Office européen des brevets



Publication number:

0 436 218 A1

EUROPEAN PATENT APPLICATION

Application number: **90125554.7**

Int. Cl.⁵: **D03D 47/30**

Date of filing: **27.12.90**

Priority: **28.12.89 JP 340080/89**

Date of publication of application:
10.07.91 Bulletin 91/28

Designated Contracting States:
BE CH DE FR GB IT LI

Applicant: **TSUDAKOMA KOGYO KABUSHIKI
KAISHA**
18-18 5-chome, Nomachi
Kanazawa-shi Ishikawa-Ken(JP)

Inventor: **Yamada, Shigeo**
258-10, Suamamachi 2-chome
Komatsu-shi, Ishikawa-ken(JP)

Representative: **Tiedtke, Harro, Dipl.-Ing. et al**
Patentanwaltsbüro Tiedtke-Bühling-Kinne-
Grupe-Pellmann-Grams-Struif-Winter-Roth
Bavariaring 4
W-8000 München 2(DE)

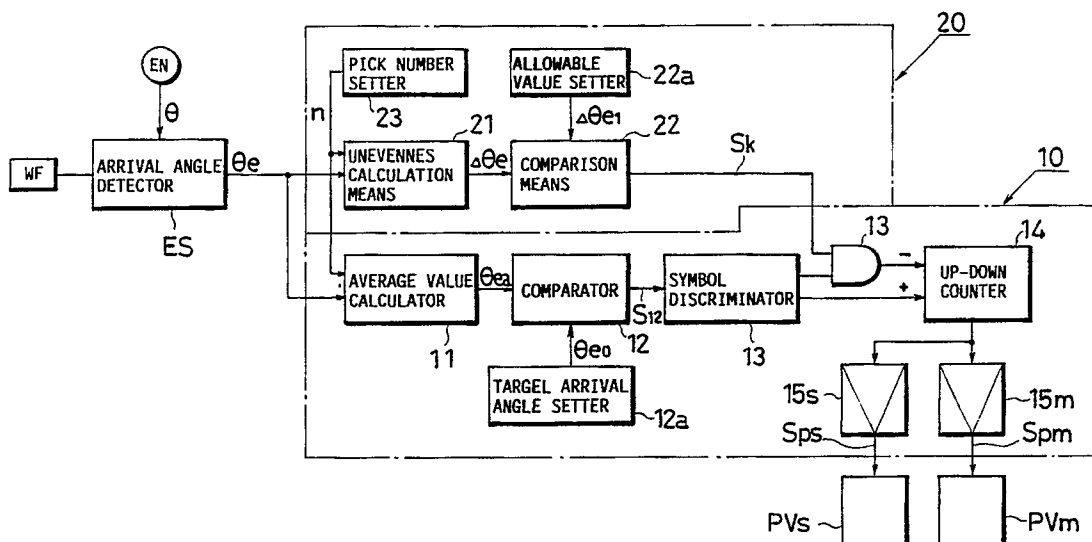
Control method for jet pressure of picking nozzle in looms and control apparatus therefor.

The present invention relates to a control method and control apparatus for controlling jet pressure of a picking nozzle in a jet room. The control method detects a flying characteristic of a filling yarn and inhibits descending control of a pressure controller for controlling the jet pressure when the unevenness exceeds a set allowable value, to prevent occurrence of picking defects such as short picking, looseness,

etc. due to excessively low jet pressure.

In the control apparatus according to the present invention, a pressure controller can be positively controlled as in the above method by an auxiliary controller provided with flying characteristic detection means, unevenness calculation means and comparison means.

Fig. 1



EP 0 436 218 A1

CONTROL METHOD FOR JET PRESSURE OF PICKING NOZZLE IN LOOMS AND CONTROL APPARATUS THEREFOR

BACKGROUND ART

This invention relates to a control method for jet pressure of a picking nozzle in a loom and control apparatus therefor in which in a jet room, even when a flying characteristic of filling yarns is varied, a stable picking operation may be continued.

In a jet room, particularly in an air jet room, when the flying characteristic of filling yarns used for weaving is changed, picking sometimes becomes unstable. It is contemplated that such an unstable picking principally results from the cause that air resistance changes since a variation in yarn properties such as coarseness of yarns, sizes of fuzz, etc. occurs lengthwise of the filling yarns.

In view of the foregoing, various procedures have been proposed in order to continuously perform the stable picking operation even when the flying characteristic of the filling yarns is changed. In the most basic procedure, a mechanical angle of a loom (hereinafter referred to as an arrival angle of filling yarns) at which a filling yarn having a predetermined length has been picked is monitored during the picking to grasp the variation of the flying characteristic of the filling yarn from the change of the arrival angle, and the jet pressure of a main nozzle and a sub-nozzle (hereinafter referred to as a picking nozzle) for picking is controlled accordingly.

Thereby, when the flying characteristic of the filling yarn lowers and a delay of the arrival angle is detected, the jet pressure is controlled to be increased in order to correct it. On the other hand, for the advancement of the arrival angle, the jet pressure is controlled to be lowered whereby the arrival angle of the filling yarn is maintained to be constant.

In controlling the jet pressure of the picking nozzle as described above, when the jet pressure is set to be extremely high or conversely extremely low for some cause, broken yarns, short-picking, looseness, etc. sometimes occur. Therefore, it has been proposed to provide a suitable upper limit value and lower limit value for the control range of the jet pressure (for example, Japanese Patent Application Laid-Open (Kokai) No. 63(1988)-92753).

However, according to the prior art as described, there is a problem in that it is not always easy to determine a proper control range of the jet pressure. That is, generally, the flying characteristic of the filling yarns varies along with a yarn supply package and even one and the same supply package is different in the flying characteristic in its

outer layer portion and inner layer portion. Therefore, even if the upper limit value and lower limit value of the jet pressure are simply manually set, the jet pressure to be controlled is not always suited to the flying characteristic of the filling yarns being supplied. Accordingly, it is difficult to positively realize the stable picking.

It is to be noted that the upper limit value of the jet pressure is sufficed to be determined to a degree that the broken filling yarn does not occur, and therefore a significant problem will not occur even if a fixed value is manually set. On the other hand, unless the lower limit value is set properly, the jet pressure cannot be sufficiently lowered. For this reason, the arrival angle abnormally advances or conversely the jet pressure excessively lowers, possibly giving rise to occurrence of picking defects such as looseness, short-picking, etc.

Generally, when a jet pressure P of the picking nozzle lowers, an arrival angle θ_e increases its unevenness $\Delta\theta_e$ every picking as shown in FIG. 6. Even if the average arrival angle θ_{eo} is not greatly varied from a target arrival angle θ_{eo} , there possibly exceeds an allowable arrival limit $\Delta\theta_{eo}$ momentarily due to the unevenness $\Delta\theta_e$.

OBJECT OF THE INVENTION

In view of the aforesaid problems noted above with respect to prior art, it is a principal object to provide a control method for jet pressure of a picking nozzle in a loom and control apparatus therefor in which a flying characteristic of a filling yarn every picking is monitored, and at least a lower limit value of jet pressure is automatically set on the basis thereof to thereby realize a continuation of stable picking operation without occurrence of picking defects such as looseness, short-picking or the like.

DISCLOSURE OF THE INVENTION

According to the control method of the present invention, even if the flying characteristic of the filling yarns is varied, the lower limit value of the jet pressure of the picking nozzle can be optimally automatically set. That is, when the flying characteristic of the filling yarns increases, a pressure controller controls the jet pressure P of the picking nozzle in a descending direction in order to correct it. The arrival angle θ_e of the filling yarn greatly becomes uneven in the neighbourhood of the target arrival angle θ_{eo} every picking with the lowering of the jet pressure P , as has been explained in

connection with FIG. 6. Therefore, if a set allowable value $\Delta\theta e1$ having a smaller width than the allowable arrival angle $\Delta\theta eo$ is determined as shown in FIG. 3 and when the unevenness $\Delta\theta e$ of the arrival angle θe exceeds the set allowable value $\Delta\theta e1$, the descending control of the jet pressure P is inhibited, jet pressure $P=PL$ at that time is to be set as a lower limit value of the jet pressure P. Since the jet pressure P is no longer lowered from the lower limit value PL, the unevenness $\Delta\theta e$ of the arrival angle θe will not increase exceeding the set allowable value $\Delta\theta e1$. Accordingly, the stable picking can be continued.

If the flying characteristic of the filling yarns is further increased after the jet pressure P has been restricted to the lower limit value PL, the arrival angle θe advances by a deviation δ on the average from the target arrival angle. However, it is easy that the set allowable value $\Delta\theta e1$ is set so as to have the following relationship:

$$\delta < |\Delta\theta eo - \Delta\theta e1| / 2 = \delta 1$$

Therefore, this point does not give rise to any substantial problem.

It is noted that the flying characteristic of the filling yarns is grasped by the arrival angle θe and may be also detected by the mechanical angle range of the loom as a unit or the filling yarn flying time range as a unit.

The control apparatus according to the present invention is provided with a flying characteristic detection means, an unevenness calculation means and a comparison means. The unevenness of the flying characteristic of the filling yarns which detected by the flying characteristic detection means, is calculated by the unevenness calculation means, the comparison means detects that the calculated unevenness exceeds a set allowable value, and the comparison means causes a pressure controller to inhibit descending control of jet pressure. Thus, the method of the present invention can be easily carried out.

If an arrival angle detector is used as the flying characteristic detection means, the flying characteristic of the filling yarns can be grasped by the arrival angle of the filling yarn; and if a flying time detector is used, the flying characteristic can be grasped by the mechanical angle range of the loom or the filling yarn flying time using a time as a unit.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a flow chart of the entire configuration showing one example of a control apparatus according to the present invention; FIG. 2 is a conceptual view of the entire configuration of an air jet

room to which is applied the apparatus according to the present invention; FIG. 3 is a diagram for explaining the operation according to the method of the present invention; FIGS. 4 and 5 are flow charts of essential parts showing a further embodiment of the control apparatus according to the present invention; and FIG. 6 is a diagram for explaining the operation according to a conventional method.

W ... filling yarn,

P, Pm, Ps ... jet pressure,

θe ... arrival angle,

t ... filling yarn flying time,

$\Delta\theta e, \Delta t$... unevenness,

$\Delta\theta e1, \Delta t1$... set allowable value,

n ... set pick number

DETAILED DESCRIPTION OF THE INVENTION

Embodiments will be described hereinafter with reference to the drawings.

The loom is an air jet room as shown in FIG. 2. A filling yarn W released from a yarn supply package W1 is picked into a warp shed WP via a drum type filling yarn length-measuring and storing device (hereinafter termed a storing device) D and a main nozzle MN. A plurality of grouped sub-nozzles SNa ... SNn are disposed along the travel path of the yarn W.

The storing device D is provided with a lock pin D1 and a release sensor D2. The yarn W wound about and stored on a drum D3 is picked by driving the lock pin D1 to the release position and opening valves Vm and Vsi ($i = a, b \dots n$) to actuate the main nozzle MN and sub-nozzles SNa ... SNn in response to picking signals Sd, Sm and Ssi ($i = a, b \dots n$) from a timing controller TC. A length Wn of picking is measured by the release sensor D2.

The main nozzle MN and sub-nozzles SNa ... SNn are connected to a common air source AC through closing valves Vm, Vsa, Vsi, Vsn and pressure regulating valves PVm, PVs. Jet pressures Pm and Ps are controlled by control signals Spm and Sps from a pressure controller 10. On the counter picking side of woven fabric is disposed a filling yarn feeler WF of an arrival angle detector ES for detecting an arrival angle θe of the laid filling yarn W, and a loom mechanical angle θ from an encoder EN is inputted into the arrival angle detector ES and a timing controller TC. The arrival angle detector ES inputs an output of the filling yarn feeler WF and the loom mechanical angle θ from the encoder EN, and outputs, as an arrival angle θe , the loom mechanical angle θ at the time when the yarn W arrives at the counter picking side (see FIG. 1).

A control apparatus for jet pressure of a picking nozzle of the loom comprises a combination of

a pressure controller 10 and an auxiliary controller 20 as shown in FIG. 1.

The pressure controller 10 comprises an average value calculator 11, a comparator 12, a symbol discriminator 13, an up-down counter 14 and two control amplifiers 15m and 15s connected longitudinally, each of the outputs of which is inputted, as control signals S_{pm} and S_{ps}, into the pressure regulating valves P_{vm} and P_{vs}. Into the average value calculator 11 are inputted the arrival angle θ_e from the arrival angle detector ES and a set pick number n from a pick number setter 23 included in the auxiliary controller 20. The target arrival angle θ_{eo} from a target arrival angle setter 12a is inputted into the comparator 12. One output of the symbol discriminator 13 is directly connected to an addition terminal of the up-down counter 14 while the other output thereof is connected to a subtraction terminal of the up-down counter 14 through a gate 13a.

The auxiliary controller 20 comprises an unevenness calculation means 21 and a comparison means 22 connected longitudinally. Into the unevenness calculation means 21 are branched and inputted the arrival angle θ_e from the arrival angle detector ES and the set pick number n from the pick number setter 23. A set allowable value $\Delta\theta_{e1}$ from an allowable value setter 22a is inputted into the comparison means 22, and output thereof is outputted, as an inhibition signal S_k, to the gate 13a of the pressure controller 10.

When the picking operation is normally executed, picking of the filling yarn W is started at a predetermined loom mechanical angle $\theta = \theta_s$ by the timing controller TC, in which case the arrival angle θ_e of the filling angle W has its average value θ_{ea} coincided with the target arrival angle θ_{eo} , and the unevenness $\Delta\theta_e$ every picking is extremely small as shown at left side of FIG. 3.

In the pressure controller 10, the average value calculator 11 calculates the average value θ_{ea} of the arrival angle in the set pick number n, and the comparator 12 compares the average value θ_{ea} with the target arrival angle θ_{eo} . Since $\theta_{ea} = \theta_{eo}$, a deviation signal S12 as its output is S12 = 0.

Accordingly, the symbol discriminator 13 generates no output. The jet pressures P_m and P_s of the main nozzle MN and sub-nozzles SNa ... SNn controlled by the pressure controller 10 and pressure regulating valve P_{vm} and P_{vs} are a given value P_m = P_s = P_o corresponding to a constant stored in advance in the up-down counter 14. However, each of the control amplifiers 15m and 15s has the D/A conversion function to output the control signals S_{pm} and S_{ps} to the pressure regulating valves P_{vm} and P_{vs} according to the content of the up-down counter 14, and the pressure regulating valves P_{vm} and P_{vs} realize the jet pressures

P_m and P_s corresponding to the control signals S_{pm} and S_{ps}. In FIG. 3, the jet pressures P_m and P_s are collectively shown as the jet pressure P.

On the other hand, the unevenness calculation means 21 of the auxiliary controller 20 calculates the unevenness $\Delta\theta_e$ of the arrival angle θ_e . The unevenness $\Delta\theta_e$ herein termed denotes a suitable statistic amount including a difference between maximum and minimal values of the arrival angle θ_e in addition to a standard deviation of the arrival angle θ_e in the set pick number n. Since at this time, the unevenness $\Delta\theta_e$ is $\Delta\theta_e < \Delta\theta_{e1}$, the comparison means 22 does not output the inhibition signal S_k. Accordingly, the gate 13a of the pressure controller 10 remains opened.

On the other hand, when the flying characteristic of the filling yarn W is varied to vary the average value θ_{ea} of the arrival angle θ_e , the comparator 12 outputs the deviation signal S12 in a direction of returning it to the target arrival angle θ_{eo} . Therefore, the symbol discriminator 13 adds an output signal to the addition terminal and subtraction terminal of the up-down counter 14 according to the symbol of the deviation signal S12. Thereby the up-down counter 14 increases or decreases the stored content, and therefore, the jet pressures P_m and P_s can be optimally controlled according to the flying characteristic of the filling yarn W.

In this manner, when the jet pressures P_m and P_s are lowered due to the increase of the flying characteristic of the filling yarn W during operation of the pressure controller 10, the unevenness $\Delta\theta_e$ of the arrival angle θ_e increases accordingly (FIG. 3). When the unevenness $\Delta\theta_e$ exceeds the set allowable value $\Delta\theta_{e1}$, the comparison means 22 of the auxiliary controller 20 is actuated to output the inhibition signal S_k whereby the gate 13a of the pressure controller 10 is closed, and thereafter the pressure controller 10 assumes the state where the descending control of the jet pressures P_m and P_s is inhibited. That is, the jet pressures P_m and P_s will always maintain the value at that time as the lower limit value PL. Accordingly, if the set allowable value $\Delta\theta_{e1}$ is set with sufficient allowance $\delta 1$ with respect to the allowable arrival limit $\Delta\theta_{eo}$, the stable picking can be continued thereafter.

When the flying characteristic of the filling yarn W is further increased so that the average θ_{ea} of the arrival angle θ_e cannot maintain the $\theta_{ea} = \theta_{eo}$ corresponding to the jet pressure P_m = P_s = PL, the deviation amount δ from the target arrival angle θ_{eo} occurs in the average value θ_{ea} . However, the loom continues normal picking if the deviation amount δ is small and unless the unevenness $\Delta\theta_e$ exceeds the allowable arrival limit $\Delta\theta_{eo}$. When the flying characteristic of the filling yarn W is restored to $\Delta\theta_e \leq \Delta\theta_{e1}$, the inhibition signal S_k is reset and

therefore the pressure controller 10 can be automatically returned to the normal control operation of the jet pressures P_m and P_s .

FIGS. 4 and 5 are flow charts of essential parts showing a further embodiment.

In the aforementioned example, the arrival angle detector ES forms flying characteristic detection means wherein the loom mechanical angle θ at the time when the filling yarn W arrives at the counter picking side is detected as the arrival angle θ_e to thereby detect the flying characteristic of the filling yarn W every picking. In place of the aforementioned means, there can be used a flying time detector TS wherein a time difference between a picking start signal Stc from the timing controller TC and an output signal of a filling yarn feeler WF is measured, which time is outputted as a filling yarn flying time t , as shown in FIG. 4. The filling yarn flying time t is inputted into the pressure controller 10 and the auxiliary controller 20, and may be handled exactly in the same manner as that of the aforementioned arrival angle θ_e .

It is to be noted that the flying time detector TS may measure the filling yarn flying time t using the loom mechanical angle range as a unit in place of using a time as a unit. That is, calculation may be made in a manner such that the picking start angle θ_s from the timing controller TC and the arrival angle θ_e from the arrival angle detector ES are inputted into the flying time detector TS to be $t = |\theta_e - \theta_s|$.

The unevenness calculation means 21 in these embodiments uses either arrival angle θ_e (including arrival timing) or filling yarn flying time t using a time or loom mechanical angle θ to calculate the unevenness of the flying characteristic of the filling yarn W in the set pick number n , output of which is the unevenness $\Delta\theta_e$ of the arrival angle θ_e or the unevenness Δt of the filling yarn flying time t . The comparison means 22 compares the unevennesses $\Delta\theta_e$ or Δt with the set allowable values $\Delta\theta_{e1}$ and Δt_1 . When $\Delta\theta_e > \Delta\theta_{e1}$ or $\Delta t > \Delta t_1$, the comparison means outputs the inhibition signal Sk to thereby inhibit the descending control of the jet pressures P_m and P_s with respect to the pressure controller 10.

While in the above description, the jet pressures P_m and P_s are always in the relationship of $P_m = P_s = P$, it is to be noted that for example, a suitable rate setting element is incorporated on the input side of the control amplifiers 15m and 15s to thereby provide $P_m \neq P_s$.

Furthermore, the pressure regulating valve PVs may be disposed every group of the sub-nozzles $SNa \dots SNn$ so that the jet pressures different every group may be realized. That is the jet pressures of the picking nozzles composed of the main nozzle MN and sub-nozzles $SNa \dots SNn$ are collec-

tively used, or that of the main nozzle MN alone or these desired groups among the sub-nozzles $SNa \dots SNn$ may be individually controlled by the pressure controller 10.

Moreover, the flying characteristic detection means composed of the arrival angle detector ES and the flying time detector TS may detect the flying characteristic with a suitable reference point determined in the midst of the flying path of the filling yarn W and using a time at which the yarn W arrives at the reference point as a reference in place of using a time at which the filling yarn W arrives at the counter picking side of woven fabric as a reference. Further, the output of the release sensor D2 attached to the storing device D is used in place of the output of the filling yarn feeler WF to measure the time required for picking of the filling yarn W having a predetermined picking length Wn to render the detection of the flying characteristic of the filling yarn W possible.

It is to be noted that this invention can be effectively applied to the case where the timing controller TC performs the picking control by suitably changing the picking start angle θ_s and controlling the jet pressure by means of the pressure controller 10.

As described above, according to the control method of the present invention, when the unevenness of the flying characteristic every picking exceeds the set allowable value, the descending control of the jet pressure by the pressure controller is inhibited, and therefore, the jet pressure at that time can be automatically set and used as the lower limit valve, the lower limit value of the jet pressure capable of being optimally automatically set despite the variation of the flying characteristic of the filling yarn. Accordingly, there is an excellent effect that the stable picking operation can be continued without occurrence of picking defect.

Still furthermore, in the control apparatus according to the present invention, the auxiliary controller provided with the flying characteristic detection means, the unevenness calculation means and the comparison means is attached to the pressure controller, and when the unevenness of the flying characteristic of the filling yarn exceeds the set allowable value, the descending control of the jet pressure by means of the pressure controller is inhibited to achieve the control method as described above.

The present invention relates to a control method and control apparatus for controlling jet pressure of a picking nozzle in a jet room. The control method detects a flying characteristic of a filling yarn and inhibits descending control of a pressure controller for controlling the jet pressure when the unevenness exceeds a set allowable value, to prevent occurrence of picking defects such as short

picking, looseness, etc. due to excessively low jet pressure.

In the control apparatus according to the present invention, a pressure controller can be positively controlled as in the above method by an auxiliary controller provided with flying characteristic detection means, unevenness calculation means and comparison means.

Claims

1. A control method for jet pressure of a picking nozzle in a loom, the method comprising detecting the flying characteristic of filling yarns in every picking, and when an unevenness of said flying characteristic in a set pick number exceeds a set allowable value, letting a pressure controller for controlling jet pressure of the picking nozzle include inhibition of descending control of the jet pressure.
2. The control method for jet pressure of a picking nozzle according to claim 1, wherein the flying characteristic of said filling yarn is detected by an arrival angle of the filling yarn to be detected.
3. The control method for jet pressure of a picking nozzle according to claim 1, wherein the flying characteristic of said filling yarn is detected by a flying time of the filling yarn to be detected.
4. The control method for jet pressure of a picking nozzle according to claim 3, wherein the flying characteristic of said filling yarn is detected using a loom mechanical angle range as a unit.
5. The control method for jet pressure of a picking nozzle according to claim 3, wherein the flying characteristic of said filling yarn is detected using a time as a unit.
6. A control apparatus for jet pressure of a picking nozzle in a loom comprising a pressure controller for controlling jet pressure of a picking nozzle and an auxiliary controller attached to said pressure controller, said auxiliary controller comprising flying characteristic detection means for detecting the flying characteristic of the filling yarn every picking, unevenness calculation means for calculating the unevenness of the flying characteristic in a set pick number from output of said flying characteristic detection means, and comparison means in which when the unevenness from said unevenness calculation means exceeds a set allowable val-

ue, descending control of jet pressure is inhibited with respect to said pressure controller.

7. The control apparatus for jet pressure of a picking nozzle according to claim 6, wherein said flying characteristic detection means comprises an arrival angle detector for detecting an arrival angle of the filling yarn.
8. The control apparatus for jet pressure of a picking nozzle according to claim 6, wherein said flying characteristic detection means comprises a flying time detector for detecting a filling-yarn flying time.

Fig. 1

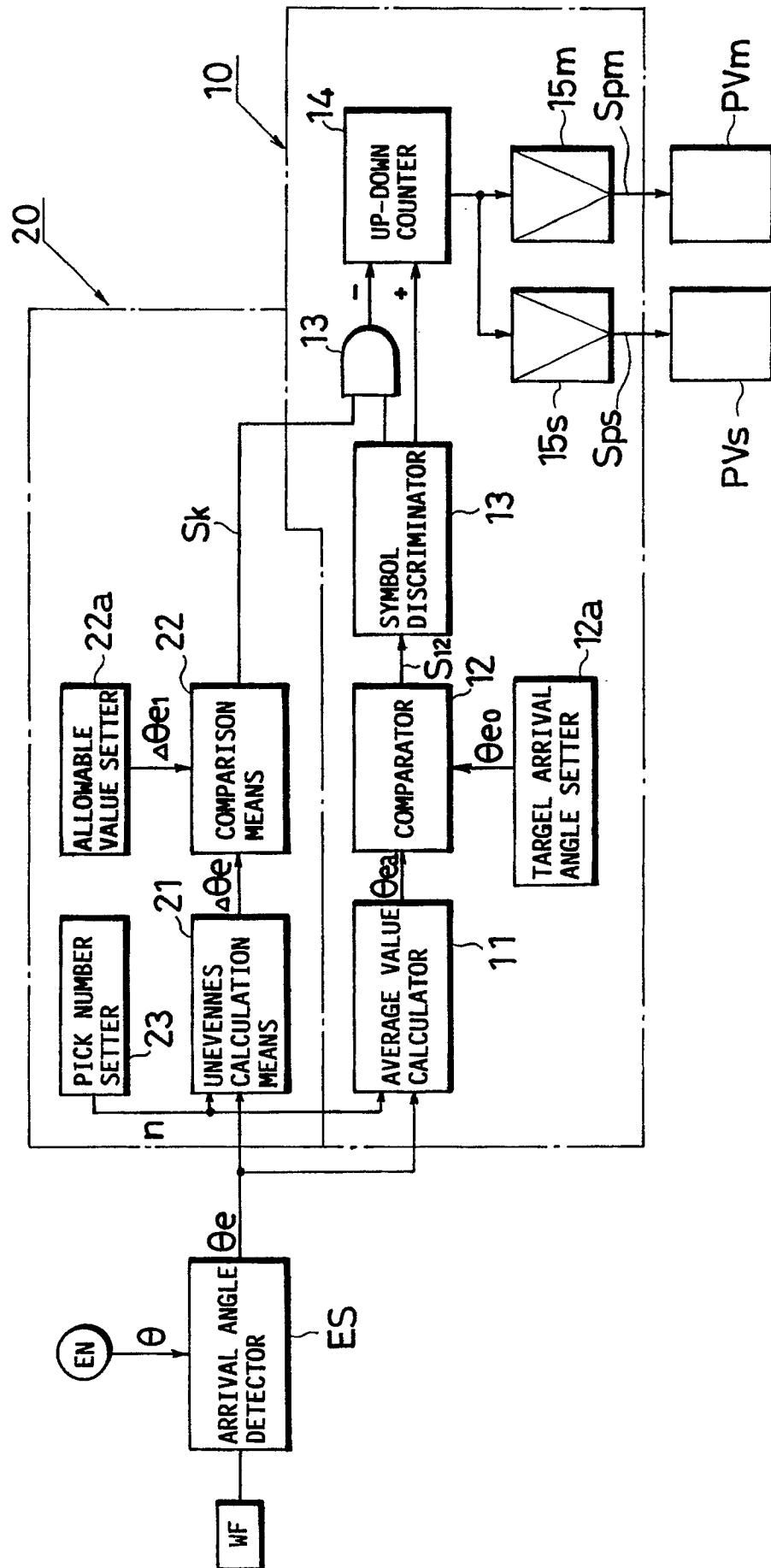


Fig. 2

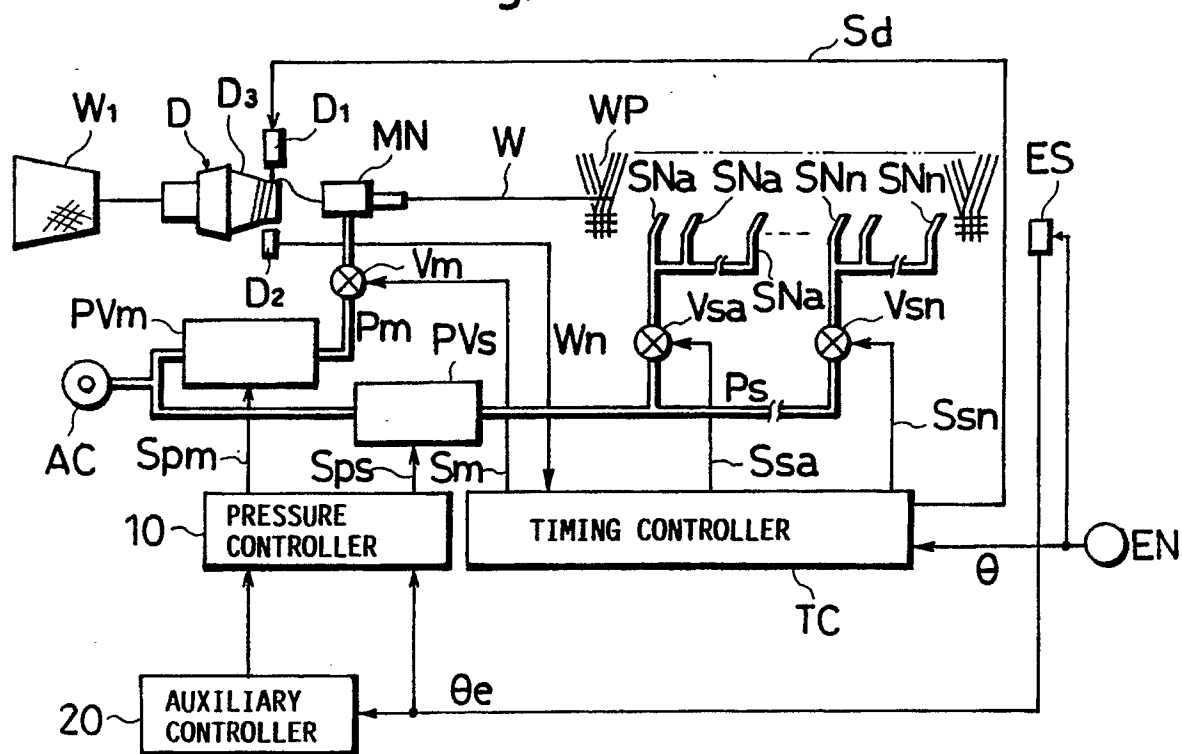


Fig. 3

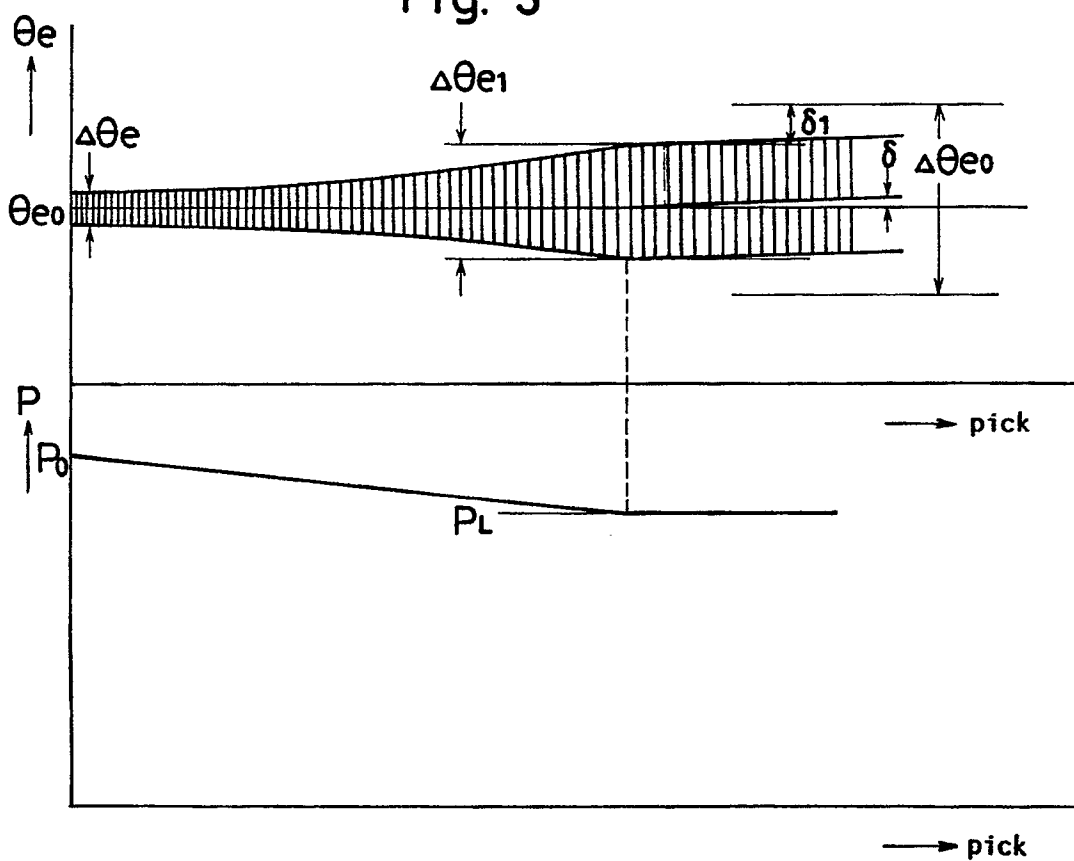


Fig. 4

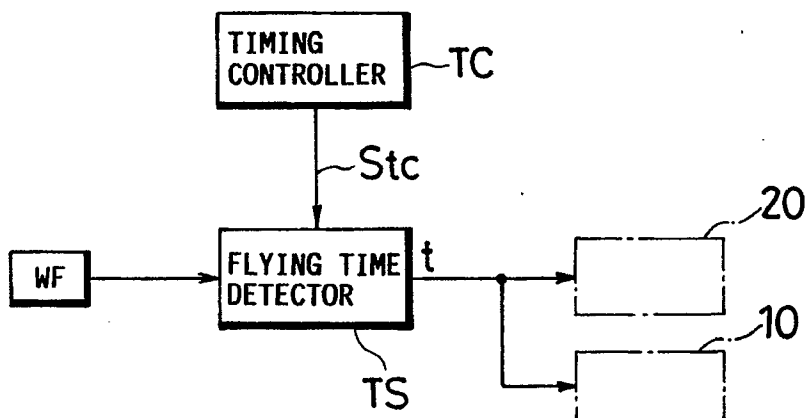


Fig. 5

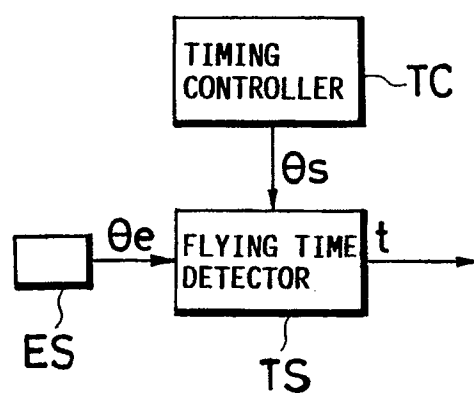
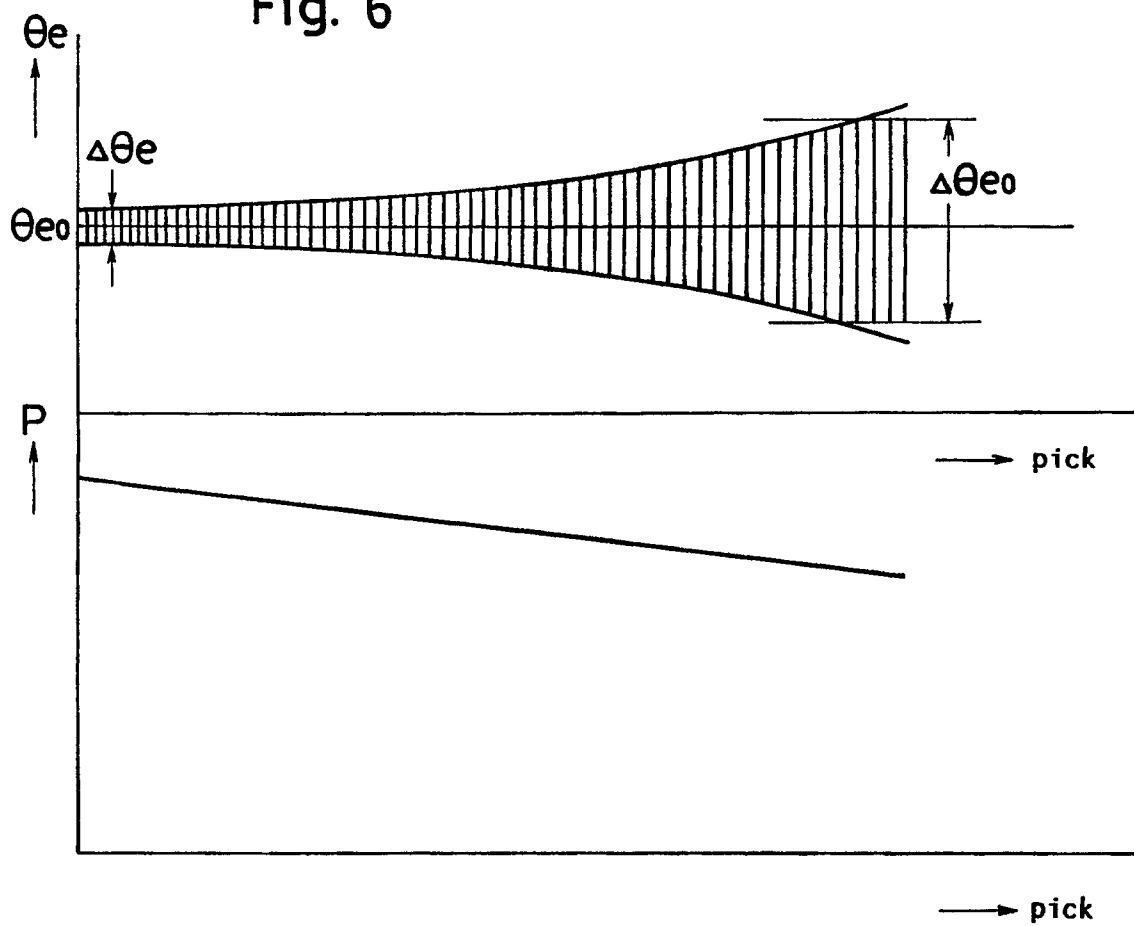


Fig. 6





European
Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 90 12 5554

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	EP-A-0 276 829 (TSUDAKOMA) * Whole document *	1-8	D 03 D 47/30
A	EP-A-0 234 064 (TSUDAKOMA) * Abstract *	1,2,4,7	
A	JAPANESE PATENTS GAZETTE, week 8822, section Ch, class D, no. AN-88151631, Derwent Publications Ltd, London, GB; & JP-A-63 092 753 (TOYODA) 23-04-1988 (Cat. D)	1,3,5,8	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			D 03 D
The present search report has been drawn up for all claims			
Place of search		Date of completion of search	Examiner
The Hague		04 April 91	BOULEGIER C.H.H.
CATEGORY OF CITED DOCUMENTS X: particularly relevant if taken alone Y: particularly relevant if combined with another document of the same category A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: earlier patent document, but published on, or after the filing date D: document cited in the application L: document cited for other reasons &: member of the same patent family, corresponding document			